WHAT IS CLAIMED IS:

1. A method of predistorting a complex baseband signal x having an in-phase component I and a quadrature component Q, said method comprising the steps of:

sampling the complex baseband signal x to obtain k samples I_k of the in-phase component and k samples Q_k of the quadrature component;

for each of the obtained samples determining a respective distortion factor $D_k = \{(\text{atanh}\,(Cx_k))/Cx_k\}e^{-jM_k}$, where $M_k = (Bx_k \tanh\,(Cx_k))/6$, x_k is the magnitude of the sample k, and C is a scaling factor;

multiplying each of the samples I_k of the in-phase component and each of the samples Q_k of the quadrature component by its respective distortion factor D_k to obtain a predistorted in-phase component sample and a predistorted quadrature component sample; and

combining the predistorted in-phase component samples and the predistorted quadrature component samples to provide a predistorted combined signal.

2. A method as claimed in claim 1, wherein for each of the k samples the respective distortion factor D_k is determined by:

determining the magnitude I_k of each of the k samples of the in-phase component and the magnitude Q_k of each of the k samples of the quadrature component;

for each of the k pairs of corresponding samples of the in-phase component and the quadrature component, determining a respective value of $x_k = (I_k^2 + Q_k^2)^{1/2}$; and

for each value of x_k, determining a value of $\tanh\,(Cx_k)$ and a value of $(\text{atanh}\,(Cx_k))/Cx_k$.

3. A method as claimed in claim 2, wherein for each value of x_k the value of tanh (Cx_k) is determined from a lookup table.

4. A method as claimed in claim 2, wherein for each value of x_k the value of atanh $(Cx_k)/Cx_k$ is determined from a lookup table.

5. A method as claimed in claim 2, wherein for each of the k pairs of corresponding samples the respective value of x_k is determined by:

detecting the maximum value of I_k and Q_k by determining the larger of I_k and Q_k;

detecting the minimum value of I_k and Q_k by determining the smaller of I_k and Q_k;

calculating a value $y_k = ½$ {(the detected minimum value) ÷ (the detected maximum value)}^{2}; and

calculating a value of $(I_k^2 + Q_k^2)^{½}$ as a function of y_k.

6. A method as claimed in claim 5, wherein the value of $(I_k^2 + Q_k^2)$ is calculated as (the detected maximum value) × $\{(1 + y_k)/2 + ½\,(1 + y_k - y_k^2 + y_k^3 - y_k^4 + y_k^5 - y_k^6)\}$.

7. A method of generating an envelope predistorted radio frequency signal, said method comprising the steps of:

providing an envelope modulated signal including a complex baseband signal x having an in-phase component I and a quadrature component Q;

sampling the complex baseband signal x to obtain k samples I_k of the in-phase component and k samples Q_k of the quadrature component;

for each of the obtained samples determining a respective distortion factor D_k = $\{(\text{atanh}\,(Cx_k))/Cx_k\}e^{-jM_k}$, where $M_k = (Bx_k \tanh\,(Cx_k))/6$, x_k is the magnitude of the sample k,

and C is a scaling factor;

multiplying each of the samples I_k of the in-phase component and each of the samples Q_k of the quadrature component by its respective distortion factor D_k to obtain a predistorted in-phase component sample and a predistorted quadrature component sample;

combining the predistorted in-phase component samples and the predistorted quadrature component samples to provide a predistorted combined signal;

up-converting the predistorted combined signal to provide a radio frequency signal; and

applying the radio frequency signal to a power amplifier have hyperbolic tangent distortion.

8. A method as claimed in claim 7, wherein for each of the k samples the respective distortion factor D_k is determined by:

determining the magnitude I_k of each of the k samples of the in-phase component and the magnitude Q_k of each of the k samples of the quadrature component;

for each of the k pairs of corresponding samples of the in-phase component and the quadrature component, determining a respective value of $x_k = (I_k^2 + Q_k^2)^{1/2}$; and

for each value of x_k, determining a value of $\tanh(Cx_k)$ and a value of $(\text{atanh}(Cx_k))/Cx_k$.

9. A method as claimed in claim 8, wherein for each value of x_k the value of $\tanh(Cx_k)$ is determined from a lookup table.

10. A method as claimed in claim 8, wherein for each value of the x_k the value of $\text{atanh}(Cx_k)/x_k$ is determined from a lookup table.

11. A method as claimed in claim 8, wherein for each of the k pairs of corresponding samples the respective value of x_k is determined by:

detecting the maximum value of I_k and Q_k by determining the larger of I_k and Q_k;

detecting the minimum value of I_k and Q_k by determining the smaller of I_k and Q_k;

calculating a value $y_k = \frac{1}{2}\{$(the detected minimum value) $\div$ (the detected maximum value)$\}^2$;

calculating a value of $(I_k^2 + Q_k^2)^{1/2}$ as a function of y_k.

12. A method as claimed in claim 11, wherein the value of $(I_k^2 + Q_k^2)$ is calculated as (the detected maximum value) $\times \{(1 + y_k)/2 + \frac{1}{2}(1 + y_k - y_k^2 + y_k^3 - y_k^4 + y_k^5 - y_k^6)\}$.

13. A method as claimed in claim 7, further comprising the step of:

transmitting the radio frequency signal.

14. A method as claimed in claim 7, wherein the scaling factor C is based on a comparison of the envelope of the complex baseband signal x and the envelope of the radio frequency signal.

15. Apparatus for predistorting a complex baseband signal x having an in-phase component I and a quadrature component Q, said apparatus comprising:

a sampling circuit for sampling the complex baseband signal x to provide k samples I_k of the in-phase component and k samples Q_k of the quadrature component;

a distortion determining circuit for determining for each of the provided samples a respective distortion factor $D_k = \{(\text{atanh}(Cx_k))/Cx_k\}e^{-jM_k}$, where $M_k = (Bx_k \tanh(Cx_k))/6$, x_k is the magnitude of the sample k, and C is a scaling factor;

a first multiplier for multiplying each of the samples I_k of the in-phase component and each of the samples Q_k of the quadrature component by its respective distortion factor D_k to obtain a predistorted in-phase component sample and a predistorted quadrature component sample; and

a summing circuit for combining the predistorted in-phase component samples and the predistorted quadrature component samples to provide a predistorted combined signal.

16. Apparatus as claimed in claim 15, wherein said distortion determining circuit comprises:

a first calculation circuit for determining for each of the k pairs of corresponding samples of the in-phase component and the quadrature component, a respective value of $x_k = (I_k^2 + Q_k^2)^{1/2}$; and

a second calculation circuit for determining for each value of x_k a value of $\tanh(Cx_k)$ and a value of $(\operatorname{atanh}(Cx_k))/Cx_k$.

17. Apparatus as claimed in claim 16, wherein said second calculation circuit includes a plurality of lookup tables.

18. Apparatus as claimed in claim 16, wherein said first calculation circuit comprises:

first means for detecting the maximum value of I_k and Q_k by determining the larger of I_k and Q_k;

second means for detecting the minimum value of I_k and Q_k by determining the smaller of I_k and Q_k;

third means for calculating a value of $y_k = ½ \{(\text{the detected minimum value}) \div (\text{the detected maximum value})\}^2$; and

fourth means for calculating a value if $(I_k^2 + Q_k^2)^{1/2}$ as a function of y_k.

19. Apparatus as claimed in claim 16, wherein said first calculating circuit calculates the value of $(I_k^2 + Q_k^2)^{1/2}$ as (the detected maximum value) $\times$ $\{(1 + y_k)/2 + ½ (1 + y_k - y_k^2 + y_k^3 - y_k^4 + y_k^5 - y_k^6)\}$.

20. Apparatus as claimed in claim 15, wherein said sampling circuit, said distortion determining circuit, said first and second multipliers, and said summing circuit comprise a gate array.

21. Apparatus as claimed in claim 20, wherein said gate array is a field programmable gate array.

22. Apparatus for generating an envelope predistorted radio frequency signal, said apparatus comprising:

a source of an envelope modulated signal including a complex baseband signal x having an in-phase component I and a quadrature component Q;

a sampling circuit for sampling the baseband signal x to provide k samples I_k of the in-phase component and k samples Q_k of the quadrature component;

a distortion determining circuit for determining for each of the provided samples a respective distortion factor $D_k = \{(\operatorname{atanh}(Cx_k))/Cx_k\}e^{-jM_k}$, where $M_k = (Bx_k \tanh(Cx_k))/6$, x_k is the magnitude of the sample k, and C is a scaling factor;

a first multiplier for multiplying each of the samples I_k of the in-phase component and each of the samples Q_k of the quadrature component by its respective distortion factor D_k to obtain a predistorted in-phase component sample and a predistorted quadrature component sample;

a summing circuit for combining the predistorted in-phase component samples and the predistorted quadrature component samples to provide a predistorted combined signal;

an up-converter for up-converting the predistorted combined signal to provide a radio frequency signal; and

a power amplifier having hyperbolic tangent distortion for amplifying the radio frequency signal while canceling the predistortion therein.

23. Apparatus as claimed in claim 22, wherein said distortion determining circuit comprises:

a first calculation circuit for determining for each of the k pairs of corresponding samples of the in-phase component and the quadrature component, a respective value of $x_k = (I_k^2 + Q_k^2)^{½}$; and

a second calculation circuit for determining for each value of x_k a value of (tanh (Cx_k) and a value of atanh (Cx_k))/Cx_k.

24. Apparatus as claimed in claim 23, wherein said second calculation circuit includes a plurality of lookup table.

25. Apparatus as claimed in claim 23, wherein said first calculation circuit comprises:

first means for detecting the maximum value of I_k and Q_k by determining the larger of I_k and Q_k;

second means for detecting the minimum value of I_k and Q_k by determining the smaller of I_k and Q_k;

third means for calculating a value of $y_k = ½$ {(the detected minimum value) = (the detected maximum value)}^{2}; and

fourth means for calculating a value if $(I_k^2 + Q_k^2)^{1/2}$ as a function of y_k.

26. Apparatus as claimed in claim 23, wherein said first calculation circuit calculates the value of $(I_k^2 + Q_k^2)^{1/2}$ as (the detected maximum value) $\times$ $\{(1 + y_k)/2 + \frac{1}{2}(1 + y_k - y_k^2 + y_k^3 - y_k^4 + y_k^5 - y_k^6)\}$.

27. Apparatus as claimed in claim 22, wherein said sampling circuit, said distortion determining circuit, said first and second multipliers, and said summing circuit comprise a gate array.

28. Apparatus as claimed in claim 27, wherein said gate array is a field programmable gate array.

29. Apparatus as claimed in claim 22, further comprising a circuit for providing the scaling factor C based on a comparison of the envelope of the complex baseband signal *x* and the envelope of the radio frequency signal.